Annual Business Report of the Tundra Ecosystem Research Station Daring Lake, Northwest Territories Calendar Year 2007

Northwest Territories Environment and Natural Resources

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ABSTRACT

The Tundra Ecosystem Research Station at Daring Lake, NT. was established in 1994. The impetus for the research station was as a monitoring site in response to the development of the EKATI diamond mine locate approximately 100 km south east of Daring Lake. In addition to ecosystem monitoring, the Research Station has been a valuable asset in terms of other environmental research, and educational programs. In 2007 the Research Station was in operation for 151 days. The number of person days in 2007 increased approximately 9% from 2006, and on average 9 people were at the camp per day (up 11% from the previous year). A total of 90 people used the camp in 2007, with the majority being University researchers (51% of all camp users). In total 13 Government led research programs took place in 2007 and 14 university programs. Several studies were funded by the International polar Year (IPY) program, and it is expected that more IPY projects will take place in 2008 and 2009. The station had several upgrades in 2007 including an incinerator, portable satellite phone and wireless internet. The majority of the funding for the station was supplied by Indian and Northern Affairs Canada.

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INTRODUCTION

In 1994, the Department of Environment and Natural Resources (ENR), Government of the Northwest Territories established the Tundra Ecosystem Research Station at Daring Lake, NWT largely in response to impending diamond development in the central barrens. Over the past 15 years, ENR has developed many partnerships with other government departments, universities, industry, and communities to conduct a wide range of short-term research and long-term environmental monitoring programs. The success of the research station to facilitate both research and monitoring activities is due in part to its partners and the cooperative process that has developed to manage the facility in an effective and efficient manner.

This paper focuses on the management model used for the Tundra Ecosystem Research, and an overview of the research and monitoring programs that have been conducted over the past 15 years. The Department of Environment and Natural Resources is interested in soliciting new partners in its research and monitoring program in this sub-arctic environment. Research priorities and opportunities will be discussed.

The number of environmental programs and facilities associated with the Station has increased considerably. In the early years, many of the research and monitoring programs were wildlife studies, both baseline and effects studies, addressing issues related to impending diamond mine developments in the Lac de Gras area. Many of these studies were associated with the West Kitikmeot Slave Study that was carried out from 1996 to 2001.

Over the last 6 years, the Department of Environment and Natural Resources (ENR),

The purpose of this report is two fold. First, it is to report on the activities and business aspects of the research station over the past calendar year and secondly, to provide a template for future annual reports to track the administrative and business activities of the Station. The reporting period of a calendar year was chosen to capture all field and business activities that occur within a season of station operation.

Tundra Ecosystem Research Station – 1994

Mandate of the Station

The Department of Environment and Natural Resources is committed to:

1. Provide a quality field station and safe working environment for users;
2. Provide a state-of-the-art facility that demonstrates new technologies;
3. Assist with logistic support and subsidize researchers' logistic costs;
4. Provide overall camp management, including administration and maintenance, both on-site and in Yellowknife;

5. Coordinate field activities and use of the facilities for all parties including researchers, environmental monitors, enforcement personnel, and educators; and
6. Make the research station available for environmental education programs, meetings and other appropriate uses.

Current Facilities

From its early beginnings of three Weatherhaven buildings, the Tundra Ecosystem Research Station has grown on an annual basis to accommodate an increasing numbers of researchers. Presently, the camp consists of 10 buildings that include 2 accommodation buildings, a cooking/dining hall, a washhouse, 2 laboratories and several buildings for storage and maintenance of equipment. In 2006, the fenced-in compound was increased in size to accommodate the expanded facilities. The camp can comfortably accommodate up to 15 persons during the winter months when heated buildings are required and up to 20 persons during the summer months when extra accommodation is available through the use of small tents. During ENR's annual Tundra Science Camp (10 days in late July to early August), camp numbers peak at approximately 35 individuals. The Station provides a variety of laboratory and field equipment, including boats and motors, and snowmobiles for use by researchers. In July 2007, the power supply system for the Station was replaced to address issues related to an aging power generation system and an increasing demand for electrical power in the camp. The renovations included the addition of 4 –100W solar panels, a new inverter, monitors and controllers, a new 24V battery bank

and a 1000W wind turbine. The power system now generates 1000W of solar power and 1000W of wind power for use in the camp. Other improvements included a new office/accommodation building, an outhouse facility that utilizes a propane powered incinerating toilet, a Smart Ash© waste incinerator, and installation of high-speed wireless Internet.

Tundra Ecosystem Research Station - 2007

Camp Management and Administration

As the research station evolved over time, so has the administration and management of the facility. In its early years of existence, the camp was built and managed primarily with the use of volunteers; even the on-site Camp Manager was a non-government volunteer. Overall management and coordination of activities at the camp is presently the responsibility of the Environmental Assessment (EA) Biologist in Wildlife Division, ENR. Since 2000, the Department has hired a seasonal full-time Camp Manager who resides at the camp from May to September. In addition to carrying out the administrative and managerial responsibilities of the position, the Camp Manager, who is usually a

biology summer student, conducts fieldwork for a number of on-going research and monitoring programs for the Department.

The Tundra Ecosystem Research Station is not a full service facility and operates on a partial cost recovery basis. Researchers that stay at the Station are required to assist in a variety of camp activities such as building maintenance, cooking, and cleaning. These various volunteer activities ensure that daily user fees are kept to a minimum. Currently, the per diem charged to users is subsidized by the Department of Environment and Natural Resources by more than 50 percent. Monies collected through per diems cover expenses such as yearly improvements, fuel oil for heating, propane for cooking, consumable materials and supplies, and air charters to transport materials and supplies, including groceries.

In addition to overall management of the Station, the EA Biologist is responsible for supervising the on-site Camp Manager. Administrative duties are shared between the EA Biologist in Yellowknife and the Camp Manager. Such duties include arranging logistic support for researchers (e.g. air charters and ground transportation), shipping and handling of equipment, supplies and samples to and from the camp, tracking camp costs (including payables and receivables), and arranging other user requirements such as first-aid and bear safety courses. In 2007, a new ENR run, centralized system of scheduling air charters (for all users) and purchasing food and supplies for the camp was implemented. Although this created more work for station staff, the system proved to be far more cost effective and efficient for all parties. The EA Biologist

also makes decisions with respect to infrastructure needs, major purchases, and maintenance requirements. In some cases, contract services are procured for some aspects of station maintenance.

To address safety and liability issues, ENR station management requires that all users sign a "Waiver of Liability" form, and comply with a "Conditions of Use" form that addresses issues and requirements pertaining to firearm safety and use, bear safety training and first-aid, emergency response preparedness, research permits, etc.

Logistic support by Twin Otter

Partnerships

As stated earlier, the operational model at the Tundra Ecosystem Research Station depends on the participation, cooperation and cost sharing of all its partners, including users and stakeholders (see Table 1). Contributions to the Station include in-kind support, cost sharing of air charters, direct financial

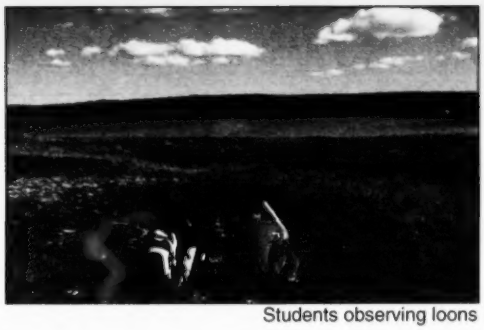
contributions (both operations and maintenance, and capital dollars), donations of equipment, supplies and fuel, plus a variety of other goods and services.

Table 1. Partners in the Tundra Ecosystem Research Station

Government of the Northwest Territories	Government of Canada
Wildlife Division, ENR	Indian and Northern Affairs Canada (INAC)
North Slave Region, ENR	Environment Canada (EC)
Environmental Protection Division, ENR	Meteorological Service of Canada (MSC)
Policy, Legislation and Communications Division, ENR	Department of Fisheries and Oceans (DFO)
Prince of Wales Northern Heritage Centre, ECE	
Universities	**Other Agencies**
Queens University	Arctic Ecology and Development Consulting
University of British Columbia (UBC)	Tlicho Community Services Agency
Trent University	Yellowknife Education District #1
Wilfrid Laurier University (WLU)	Yellowknife Catholic School Board
University of Calgary (UofC)	
Carleton University	
University of Northern British Columbia (UNBC)	
University of Saskatchewan	

Station Use

During 2007, the Tundra Ecosystem Research Station was operated for a total of 151 days between March 14 and September 12. The number of person days the Station was used was 1370 compared to 1255 the previous year. The average number of people in camp increased from 8.2 per day in 2006 to 9.1 per day in 2007, an increase of 11%. University researchers continue to be the majority user group at Daring Lake with a combined use of 51% (see Figure 1). The number of individuals that used the facilities in 2007 was 90.



Students observing loons

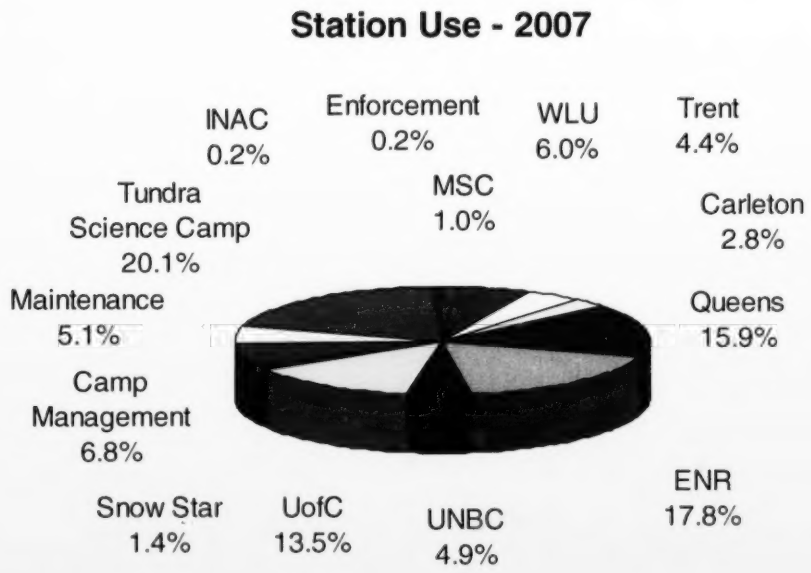


Figure 1. Station Use – 2007 (Use based on total person days) nb: WLU – Wilfrid Laurier University, UNBC – University of Northern British Columbia, UofC – University of Calgary,

Currently, the research station is operated as a seasonal facility. Although it could operate year-round, there has been little interest from researchers wishing to use the camp during the winter months.

Research and Monitoring Programs

The Tundra Ecosystem Research Station supports a wide range of research and monitoring programs. Some of the research studies are short-term and are generally completed in one to two years. Other long-term research and monitoring programs are on-going and have been in existence for more than ten years. Many of the monitoring studies that are conducted at Daring Lake are "control" studies contributing to the assessment of the effects of mining developments in the region. The facilities also support other activities such as environmental educational programs (e.g. Tundra Science Camp) and enforcement work being conducted by Renewable Resource Officers (ENR), Fisheries Officers (DFO), and Land Use Inspectors (INAC).

The Department of Environment and Natural Resources has identified a number of research and monitoring priorities for the Daring Lake area. These include:

1. Environmental impact assessment
2. Climate change
3. Biodiversity and protected areas
4. Species at risk
5. Disease and contaminants
6. Air quality

These priority areas provide a course filter for ENR to screen potential researchers wishing to conduct their research in the Daring Lake area using the government's research station. The Department encourages cooperative

research and monitoring work, integrated and interdisciplinary programs, studies that involve northerners (including northern students) and traditional knowledge. In addition to providing logistic support and subsidizing researchers' daily costs, the Department sponsors several researchers by providing financial assistance through NSERC's Northern Intern Program.

Communication and dissemination of study results to communities, northerners and the general public is an important component of every study. Researchers are encouraged to prepare research papers, posters and lay person summaries for a variety of audiences. Northern forums such as the Science in the Changing North Conference and the Geoscience Forum are annual events that are used to present research findings in addition to publishing in journals or other media.

Table 2 provides a list of the current research and monitoring programs being conducted by government agencies in the Daring Lake area. Table 3 is a list of the university research programs. In some cases, fieldwork has been completed and report writing is underway.

Table 2. Government Research and Monitoring Programs in the Daring Lake Area – 2007

Project	**Priority**	**Researcher Affiliation**
Water quality monitoring of the Coppermine River Basin	Climate change, Environmental impact assessment	Robin Staples, Bob Reid, INAC
Hydrology and weather monitoring	Climate change	Bob Reid, INAC
Snow studies at Daring Lake	Climate change	Dr. Chris Derksen, Meteorological Service of Canada, EC
Air quality monitoring	Air quality, Environmental impact assessment	John McKay, ENR, GNWT
The International Tundra Experiment – monitoring the	Climate change	Karin Clark, ENR, GNWT

Project	Priority	Researcher Affiliation
effects of climate change on plant phenology		
Vegetation classification of the Daring Lake area	Environmental impact assessment, Biodiversity and protected areas	Joachim Obst, Arctic Ecology
Breeding bird surveys at Daring Lake	Climate change, Environmental impact assessment, Biodiversity and protected areas	Joachim Obst, Arctic Ecology
Small mammal monitoring – population trends	Environmental impact assessment, Biodiversity and protected areas	Steven Matthews, ENR, GNWT
Raptor monitoring in the Daring Lake area	Environmental impact assessment, Biodiversity and protected areas, Species at risk	Steven Matthews, ENR, GNWT
Interaction of biting insects and forage availability for caribou of the Bathurst herd	Climate change, Environmental impact assessment	Bruno Croft, ENR, GNWT
Denning ecology of tundra wolves	Environmental impact assessment, Biodiversity and protected areas	Dean Cluff, ENR, GNWT
Abundance and population trends of wolverines	Environmental impact assessment, Biodiversity and protected areas	Robert Mulders, ENR, GNWT
Archaeological assessment and inventory	Environmental impact assessment, Biodiversity and protected areas	Tom Andrews, Prince of Wales Northern Heritage Centre, ECE, GNWT

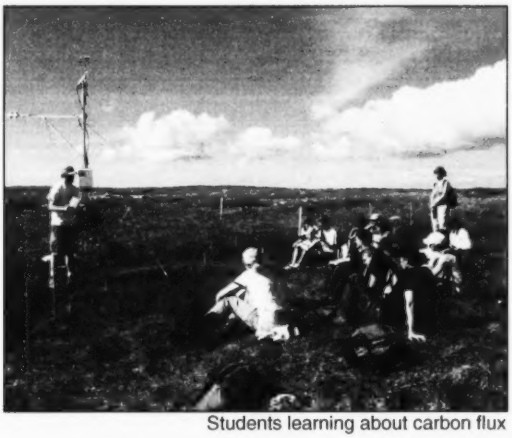
Table 3. University Research Projects in the Daring Lake Area – 2007

Project	Priority	Principle Researcher Supervisor Affiliation
Carbon flux, nutrient cycling and respiration of arctic plants	Climate change	Dr. Paul Grogan, Mat Vankoughnett, John Xu and Haiyan Chu, Queens University
Snow depth and CO^2 flux in hummock tundra	Climate change	Sonia Nobrega, Dr. Paul Grogran, Queens University
Nitrogen cycling in the arctic tundra	Climate change	Kate Buckeridge, Dr. Paul Grogan, Queen's University
Effects of caribou grazing on low arctic tundra	Climate change	Pamela O, Dr. Greg Henry, University of British Columbia
Variation in CO_2 exchange on the tundra	Climate change	Dr. Peter Lafleur, Trent University, and Dr. Elyn Humphreys. Carleton University

Project	Priority	Principle Researcher Supervisor Affiliation
Remote sensing and isotopic tools for discerning multi-scale data issues in arctic hydrology	Climate change	Andrew Rees, Dr. Michael English, Wilfrid Laurier University, and Dr. Chris Derksen, Meteorological Service of Canada, EC
Evapotranspiration in tundra plant communities	Climate change	Shawn LeCompte, Dr. Michael English, Wilfrid Laurier University
Chemical and hydrological budgets of a arctic tundra catchment	Climate change, Environmental impact assessment	Dave Woods, Dr. Michael English, Wilfrid Laurier University
Surface energy budgets/active layer growth	Climate change	Dave Turcotte, Dr. Michael English, Wilfrid Laurier University
Alaska – Canada barrenlands traverse: Observations and measurements of snow across the NWT	Climate change	Dr. Matthew Sturm, CRREL, Fairbanks, Alaska
Nitrogen fixation by free-living cyanobacteria in the arctic tundra	Climate change	Katherine Stewart, Dr. Darwyn Coxson, University of Northern British Columbia, and Dr. Steven Siciliano, University of Saskatchewan
Carbon dioxide and nitrogen flux in the southern arctic	Climate change	Shari Haynes, Dr. Elyn Humphreys, Carleton University
Development and survival of the parasite Ostertagia gruehneri in barren-ground caribou with respect to climate change	Climate change, Disease	Bryanne Hoar, Dr. Susan Kutz, University of Calgary
Near-surface thermal regime of permafrost terrain in the Slave Province	Climate change	Kumari Karunaratne, Dr. Chris Burn, Carleton University

The International Polar Year (IPY) program began in 2007 and will continue for three years. This program created some new opportunities for research and monitoring activities at Daring Lake. The Snow Star polar expedition of U.S. and Canadian scientists conducted snow surveys from Fairbanks, Alaska to Baker Lake, NWT, and spent five days at Daring Lake in April 2007. Other researchers such as Dr. Paul Grogan (Queen's University) and

Dr. Darwyn Coxson (UNBC) are working on IPY projects with international collaboration. It is expected that additional IPY projects will be carried out at the Tundra Ecosystem Research Station in 2008 and 2009 as the program becomes fully implemented.



Students learning about carbon flux

Station Costs

Improvements were made to the alternate energy power system at the research station in 2007. These improvements included a new rack of solar panels, installation of a wind generator, a new inverter, charge controller and monitoring system, and a new battery bank. It is anticipated that this new electrical system will be in operation for at least 10 years before any further upgrades are required. Other major expenses incurred in 2007 included the construction of an office building and the purchase of a forced air waste incinerator, portable satellite phone and the installation of high-speed wireless Internet.

Table 4 provides a summary of Station costs incurred in the 2007 calendar year. Other operational expenditures such as satellite phone charges, groceries and air charters for personnel were charged back to individual users as part of the Station's user pay system. The cost of shipping groceries and other supplies to the camp is not reflected in this table since these goods were transported on charters paid for by the different research groups. From May to September, ENR hired a summer student to be the on-site Camp Manager. The salary paid to this individual is included in the total operating cost. Approximately 25 percent of the Department's EA Biologist's time is also spent managing the facility. Currently, this is an in-kind contribution of the Department of Environment and Natural Resources.

Based on total expenditures for 2007 and the number of person days the Station was in operation, the cost per day per person was $71.30. At the current daily charge rate of $30.00 per person, user costs are subsidized by 58 percent.

Indian and Northern Affairs Canada continues to be a major partner in the Tundra Ecosystem Research Station providing financial and logistic support on an annual basis.

Table 4. 2007 Operating Costs

Station Improvements		Operations & Maintenance		Communication Services		Fuel		Salaries	
Alternate Energy System	$29,174.00	General Operations	$9,551.30	Satellite Phone - Annual Service Fee	$443.10	Heating Oil	$2,229.85	Camp Manager	$25,000.00
Satellite Phone	$2,000.00	Maintenance Contract	$2,400.00	Internet Service - Annual Service Fee	$247.66	Propane	$680.42	(Summer student)	
Internet Equipment	$974.31	Air Charters/Shipping	$18,449.18						
Office Building	$3,194.81								
Incinerator	$3,596.24								
TOTALS	$38,939.36		$30,400.48		$740.76		$2,910.27		$25,000.00
GRAND TOTAL	**$97,990.87**								

Successes

1) Research and Monitoring

The Tundra Ecosystem Research Station and the Daring Lake area continue to a focal point for research and monitoring in the Lac de Gras area of the Slave Geological Province. Through the research station and its partnership approach, the Department of Environment and Natural Resources has fostered cooperative relationships with a number of government departments, universities, industry and aboriginal communities. This model has lead to a diverse program of short and long-term environmental research and monitoring programs addressing many of the priority environmental issues for the region. Much of the scientific data being obtained is contributing to the collection of baseline data by filling information gaps, helping to better understand ecological processes and monitor the impacts of climate change and industrial development on species at risk and biodiversity.

2) Tundra Science Camp

The Tundra Science Camp continues to be a big success at Daring Lake. This cross-cultural environmental education program has been in existence for thirteen years. The Department of Environment and Natural Resources coordinates the Tundra Science Camp and provides core staff along with the Territorial Archaeologist from the Prince of Wales Northern Heritage Centre, Dogrib elders and other environmental education specialists. Indian and Northern Affairs Canada assists with logistic support; local Boards of Education assist with student recruitment and financial support. The Tundra Science Camp

is an opportunity for high school students and teachers in the Northwest Territories to work closely with environmental educators, on-site scientists and Dene elders to learn about field and laboratory techniques in wildlife ecology, ornithology, plant ecology, geology, archaeology, and human history. It also provides the opportunity for all participants to understand different cultures and approaches to western science and traditional knowledge.

Tundra Science Camp

3) Choices

Research and monitoring, along with environmental education programs at Daring Lake provide unique opportunities for students to work and learn about the low arctic tundra environment. The Department has encouraged researchers to hire local people and involve northern students in their programs. These opportunities provide northern students with field experience and information necessary to make future career choices. Many of the students that have been to Daring Lake have pursued post-secondary education at southern educational institutions and returned to the North to be employed in both the private and public sectors.

4) Communication

The communication and dissemination of study results are an important component of any research or monitoring program. The Department has encouraged researchers to participate in seminars, workshops and conferences to communicate their results to northern audiences. This approach helps to ensure that northerners are kept informed about the various studies and their results. To date, researchers have produced papers, posters and presented their results at various conferences and workshops in both northern and southern Canada.

Challenges and Future Activities

1) Facilities

The Tundra Ecosystem Research Station is currently operating at near capacity during the late winter, spring and summer months. Additional space could be available to accommodate a limited number of new researchers especially if the International Polar Year supports new research and monitoring projects in the Daring Lake area. Presently, there are no plans to expand the facilities of the Tundra Ecosystem Research Station primarily to ensure that the natural environment is sustained and not significantly impacted by the people working in the area. In addition, the research station as it currently operates has reached a point where any further expansion of the facilities will require the transition from a cooperative to a full service facility including such things as a full-time cook and maintenance staff. Such changes would have implications for the management of the station and the cost to researchers using the facilities.

For example, the employment of a full-time cook would increase the daily user fees by approximately $50.00 per person at the current rate of occupancy. Year-round operation of the station would also have similar implications.

2) Station Promotion

The Department of Environment and Natural Resources will continue to encourage and promote the use of the Tundra Ecosystem Research Station for priority research and monitoring programs in a partnership approach. As a partner and participant in various workshops and conferences, the Department will continue to work to assist researchers to effectively communicate their work to a variety of audiences. In 2008, the Department plans to promote the research station and its activities by developing a Tundra Ecosystem Research Station web site linked to the Wildlife Division website of ENR.

3) Research Agenda

As demand for use of the Tundra Ecosystem Research Station increases, the Department of Environment and Natural Resources will consider developing a research and monitoring agenda for the Daring Lake area. A research agenda would provide a mechanism to ensure that future research and monitoring is strategically focused to address issues of major importance to its partners and stakeholders. It would also provide a mechanism to screen researchers and their research proposals to determine who should work at the research station.

4) Protected Area

For several years, the Department and several of its partners have expressed interest in establishing the Daring Lake area as a protected area. Given the spatial and temporal scope of the fieldwork that is ongoing in the area, a protected area, as small as the Daring Lake sub-basin, would ensure the long-term integrity of the environmental studies and the study area. In 2007, the Department, through the Protected Areas Strategy, conducted a "Phase 1 Initial Ecological Assessment of the Daring Lake Area". Current plans are to continue to pursue legislative options to seek long-term protection of the area from potential future industrial development.

Summary

The Tundra Ecosystem Research Station at Daring Lake, NWT plays a vital role in promoting and providing opportunities for environmental research, monitoring and education programs in the low arctic tundra. Given the mining development that is taking place in the region, the Station plays an important role in contributing baseline information, "control" data and studying the environmental effects of mining in the Lac de Gras area. Other scientific information is also being gathered through short and long-term research and monitoring studies addressing priority issues such as climate change, contaminants and parasites, species at risk, biodiversity and protected areas.

The cooperation and contributions of all partners to support the Tundra Ecosystem Research Station is essential to ensure its on-going success.

ITEX plant phenology plots